Dear friends,

We eagerly look ahead at the months to come and know with confidence that every day will be filled with far-reaching purpose and student-centered initiative. We recruited another Professor of Practice in 2016. Professors of Practice provide students education and training not available in textbooks. We are also looking to fill three new faculty positions in 2017, including the Axalta Chair.

This fall we had the largest graduate program enrollment to date and our numbers will continue to grow. For our undergraduates, approximately 40 percent of our sophomore class is female. If you have never visited us, I invite you to come and experience in person this world-class environment of learning and excellence.

Truly,

Dr. M. Nazmul Karim - T. Michael O'Connor Chair II
Department Head | Professor

Contact: nazkarim@tamu.edu or 979.845.9806
engineering.tamu.edu/chemical

ARTIE MCFERRIN DEPARTMENT OF CHEMICAL ENGINEERING
TEXAS A&M UNIVERSITY

Faculty Index | Fall 2016

From the Department Head

**Faculty**

**Total Faculty** ........................................ 36
- Professors ........................................ 15
- Endowed Professors ......................... 8
- Chair Holders ................................. 4
- Associate Professors .................... 8
- Assistant Professors .................... 6
- Research Assistant Professors .... 1
- Lecturers/Senior Lecturers ........... 4
- Professors of Practice ................. 2

**Department Research Areas**

- Biomedicine | Biomolecules
- Biofuels | Biotechnology
- Catalysis
- Complex Fluids | Microfluidics | Soft Matter
- Computational Chemical Engineering
- Energy
- Environmental | Sustainability
- Materials | Microelectronics
- Multiscale Systems Engineering
- Nanotechnology
- Process Safety | Process Systems Engineering
- Reaction Engineering
- Thermodynamics
Dr. Balbuena’s research focuses on first-principles materials analysis and design. Using predictions of physical and chemical properties of materials via atomic-level simulations, her research contributes to an improved understanding and better design of power sources such as lithium-ion and lithium-sulfur batteries and fuel cells; as well as to the development of new materials for catalytic processes. Her interests include reactions on nanoclusters and surfaces, and at interfaces with applications to catalysis and to chemical and electrochemical degradation phenomena. Balbuena is an AAAS fellow and a TEES senior fellow.

Dr. Bukur’s research includes areas of chemical reaction engineering, applied catalysis and catalyst synthesis; GTL and CTL technology and mathematical modeling. Bukur is the vice-chairman of the Natural Gas Conversion Board and also serves on its international scientific advisory board. He is a fellow of AIChE and a TEES senior fellow. Bukur is located at the Texas A&M Qatar campus.

Dr. El-Halwagi’s research includes process synthesis, simulation, design, operation, integration and optimization. He focuses on the development of sustainable practices; eco-industrial parks; hydrocarbon processing; renewable and conventional energy systems; and systematic methodologies and strategies that enable chemical engineers to achieve productivity enhancement, yield improvement, debottlenecking, pollution prevention and energy conservation. El-Halwagi is a fellow of AIChE.

Dr. Elabd’s research includes the synthesis of new polymers for clean energy and water. Energy applications include fuel cells, batteries and capacitors; water applications include electrochemical water purification. The transport and thermodynamics of ions and small molecules in polymers guide his synthetic design principles. He is interested in answering complex questions regarding multicomponent transport, diffusion and sorption of water, ion transport and transport-morphology relationships in polymers using both an experimental and modeling approach.

Dr. Jayaraman’s research includes molecular systems biotechnology, specifically the use of integrated experimental and modeling approaches for investigating problems in human health and medicine. Current research projects include systems biology of cytokine-signaling in inflammatory diseases, interkingdom signaling interactions between bacteria and human cells in GI tract infections, and the development of microfluidic model systems for combinatorial drug screening and vascular tissue engineering.
Dr. Karim’s research deals with fundamental issues related to cellulosic biofuels production. His research focuses on metabolic engineering, in silico modeling and optimization of bioprocesses. In addition, he has developed novel dual-modal cellulosic monolith membranes for flu virus separation, purification and cell-culture-based vaccine production. Karim also researches advanced control methodologies, including the use of particle filters and nonlinear observers for pipeline leak detection, neural networks and nonlinear PCA and PLS methods for fault detection in various chemical and bioprocesses. He is a fellow of AIChE.

Dr. Kravaris’ research focuses on nonlinear process control, state estimation and dynamic model reduction. The aim is the development of systematic methodologies to be able to construct effective control and monitoring algorithms for nonlinear processes. Theoretical issues are approached with invariant manifold and Lyapunov function methods. Applications currently center on environmental and energy systems, including anaerobic digestion and activated sludge processes.

Dr. Kuo’s research includes nano and microelectronics, with emphasis on semiconductor and optoelectronic materials, processes and devices; thin films and plasma technology are also studied. In his Thin Film Nano and Microelectronics Research Laboratory, Kuo develops new materials, novel processes and advanced devices with the ultimate goal of creating high-performance, highly-reliable, manufacturable devices for present and future applications. Current projects include use of the following: TFTs, ULSIC, LEDs, solar cells and bio sensors. He is a TEES fellow, a fellow of IEEE and the Electrochemical Society.

Dr. Pistikopoulos’ research interests lie in the field of process and multiscale systems engineering, with particular emphasis on the developments of (i) model-based optimization theory and computational tools for multi-parametric programming and explicit model predictive control and (ii) an integrated framework for design, control and scheduling of complex multi-scale networks, with applications in sustainable energy systems, smart manufacturing and personalized health engineering. He is a fellow of the Royal Academy of Engineering (U.K.).

Dr. Mannan’s research interests include development of inherently safer processes, application of computational fluid dynamics to study the explosive characteristics of flammable gases, development of quantitative methods to determine incompatibility among various chemicals, application of calorimetric methods for the assessment of reactive hazards, quantitative risk assessment, LNG safety, flammability of materials, and the application of consequence analysis to assess the impact of process plant incidents. As director of the Mary Kay O’Connor Process Safety Center, Mannan has served as a consultant to numerous entities in both the academic and private sectors. He has testified before the U.S. Congress on multiple occasions, lending his expertise on matters of national security as it relates to chemical safety, protection of the chemical infrastructure, and inherent safety. He is a fellow of AIChE and Associate Fellow of IChemE (U.K.).

Dr. Seminario’s research covers several aspects of nanotechnology such as the analysis, design, and simulation of systems and materials of nanometer dimensions—especially those needed for development and systems for energy, nanosensors and nanoelectronics. Among his recent goals is the design of smaller, cleaner, more efficient and faster devices for energy production and storage as well as for detection of chemical, biological and nuclear agents. He has developed new scenarios for nanodevice architectures using a multi-scale and multidisciplinary approach that progresses from the atomistic level to the final product, guided by first principles calculations.

Dr. Ugaz’s research focuses broadly on harnessing the unique characteristics of transport and flow at the microscale, with specific interests in microfluidic flows (both single-phase and nanoparticle suspensions), microchip gel electrophoresis, PCR thermocycling in novel convective flow devices, and construction of 3D vascular flow networks for biomedical applications. The Association of Former Students has presented Ugaz a Distinguished Achievement Award for teaching.
Dr. Jeong’s research includes the development of novel methodologies to design, modify, deposit and micro-fabricate nanostructured materials and to build them into hierarchal structures and complex forms for wide ranges of applications including separation membranes, selective catalysts and adsorbents. Jeong’s research group develops several innovative and commercially viable strategies to prepare ultrathin nanoporous framework membranes with unprecedentedly high olefin/paraffin separation performances. In collaboration with Dr. Dong-Hee Son, Jeong’s team is developing highly-efficient semiconductor nanocrystal/graphene composites for photocatalytic hydrogen production.

Dr. Green’s research focuses on understanding the processing and engineering of nanomaterials in the liquid phase for use in multifunctional composites and films. Areas of interest include polymer-nanomaterial interfacial studies, microstructure-rheology coupling, nanomaterial morphology evolution and scalable nanomaterial manufacturing. His group aims to lead in bringing a chemical engineering perspective to bear on the field of nanomaterials processing.

Dr. Cheng studies complex fluids and active soft matter. His research focuses on the self-organization of intelligent colloids and anisotropic particles, the fabrication of photonic crystals and integrated photonic circuits, solar hydrogen production via water splitting, and the application of microfluidics to bioencapsulation. The techniques developed will be applicable to the modeling of phase transitions and liquid crystal materials, the engineering of nanocomposites and semiconductors of light, solar energy harvesting and a wide range of therapeutic treatments.

Dr. Wilhite’s research includes the study of interactions between chemical kinetics and transport processes for process intensification. Areas of investigation include the design of multilayer catalytic and/or perm-selective membranes for natural gas processing and hydrogen production, synthesis of electroceramic membrane material for CO2 capture and reuse, heat-exchanger microreactor technologies for natural gas processing, and catalytic gas-liquid-solid reactor design.

Dr. Vaddiraju’s research work is based primarily in the development of processes— not only for the mass production of nanowires in gram and kilogram quantities, but also for their simple, reliable and scalable integration into highly efficient energy conversion devices. His vision is to streamline the production of these devices for widespread use by mankind in easy, reliable, reproducible and inexpensive ways—a style similar to the production of pharmaceuticals (e.g., aspirin).

Dr. Kao’s research includes genomics, systems biology and biotechnology. In the lab, she utilizes related tools to observe microbial adaptation in various environments. Kao studies the evolution of microorganisms such as yeast and E. coli for their enhanced tolerance to the toxicity of desired bioproducts, such as biofuels. She uses ultrahigh throughput sequencing technology and monitors transcriptome and metabolism in an effort to identify the cellular components responsible for the selected traits.

Dr. Lutkenhaus’ research interests include the design of organic thin films and nanostructures to enable the development of novel organic energy systems and smart coatings. Areas of investigation include the behavior of polymer thin films and coatings, thermal analysis, polyelectrolytes and electroactive polymers for energy storage. Her group has made new strides in the area of bendable batteries.

Dr. Akbulut’s research interests include the fundamental issues of surface and interface science including adsorption, desorption, surface-nanoparticle interactions, internanoparticle forces, assembly of nanoparticles, adhesion, friction, wear, tribochemical reactions and corrosion— with the overarching objective of advancing nanotechnology and biotechnology through rationale design.
Dr. Hasan’s research focuses on developing theoretical and computational methods for multi-scale optimization, material systems engineering and design, process intensification, and supply chain networks. Application areas include gas separation and storage, carbon capture and conversion, sustainable fuels and chemicals.

Dr. Wu’s research includes nanotechnology and bioengineering. He integrates nanostructured materials and analytical tools to study the organization, dynamics and functions of biomolecules at biological interfaces. Applications of the developed techniques include infectious disease screening, imaging of complex biological networks that are critical to the development of disease, exploration of cell membrane function and drug discovery. Wu also focuses on synthetic mimics of the cellular surface to enable the development of novel materials and catalysis.

Dr. Kwon’s research focuses on the development of techniques for the modeling, simulation, and control of multiscale processes which are characterized by highly coupled phenomena occurring at disparate spatial and temporal scales. He applies these techniques to crystallization, hydraulic fracturing, and chemical vapor deposition processes, leading to new insights and addressing industrial concerns.

Dr. Lele’s research lies at the interface of microbial cell mechanics and biomolecular engineering. His current focus is on the molecular mechanisms by which intracellular, mechanosensitive nanomachines modulate biochemical signaling and influence bacterial adaptability and survival. The broad objective is to develop a mechanistic understanding of colonization, the spread of infections and antibiotic resistance. Techniques include single molecule fluorescence methods (TIRF, FRET, FRAP), force spectroscopy (optical tweezers) and molecular genetics.

Dr. Mashuga’s research interests are centered on experimental process safety and include flammability, dust explosions, calorimetry, energetic materials testing and internal combustion. His teaching interests support chemical process safety, process analysis and design, process control and chemical reaction engineering, among others. Mashuga brings 15 years of industrial experience from BASF and DOW Chemical in the field of chemical engineering.

Dr. Tamamis’ research includes computational methods in the area of protein structure prediction, de novo protein design and the development of novel frameworks. He targets treatment of diseases such as cancer, Alzheimer’s, and diabetes, studied at atomic and molecular levels. Similarly, he designs bionanomaterials for applications in biomedicine and nanotechnology.

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**Senior Lecturers**

**CHARLES E. ISDALE**

Isdale came to Texas A&M after working for 30 years in industry as a chemical process engineer, which remains his main area of interest. He teaches four different classes for the department.

**J. DOUG WHITE**

White has over three decades of industrial experience. His teaching focus is in the unit operations labs where students blend theory classes with actual operation of equipment and processes. A key element of these labs includes effective communication of technical subjects in line with industrial expectations. He also serves as the departmental safety officer helping ensure the safe operation of diverse research and teaching laboratories in chemical engineering.

**CHRISTIN M. WILSON**

White has over three decades of industrial experience. His teaching focus is in the unit operations labs where students blend theory classes with actual operation of equipment and processes. A key element of these labs includes effective communication of technical subjects in line with industrial expectations. He also serves as the departmental safety officer helping ensure the safe operation of diverse research and teaching laboratories in chemical engineering.

**Lecturers**

**WILLIAM J. ROGERS**

PH.D., THE OHIO STATE UNIVERSITY

Dr. Rogers is a research scientist in the Mary Kay O’Connor Process Safety Center, where he has been a scientist since 1979. His current research interest is a systems approach to engineering risk, decision making under uncertainty, and uncertainty modeling and management using traditional and Bayesian models.

**CHRISTIN M. WILSON**

PH.D., THE OHIO STATE UNIVERSITY

Dr. Wilson is a lecturer of technical writing, drawing upon a scientific background in linguistics. She has taught undergraduate writing courses for several years and edited the 11th edition of *Language Files*. Wilson’s research interests include sociohistorical linguistics and language processing.

**Research Assistant Professor**

**HOMA KHOSRAVIAN**

PH.D., UNIVERSITY OF ILLINOIS - CHICAGO

Dr. Khosravian’s research interests span the areas of nanotechnology, environment and sustainability. Her research combines the experimental and theoretical methods to develop nanomaterials that aid to sustain the environment. Her current research includes biosynthesis of nanomaterials, environmental health and safety of engineered nanomaterials, and heterogeneous catalysis.

**Courtesy / Joint Appointments**

**M. KATHERINE BANKS**

VICE CHANCELLOR FOR ENGINEERING, TEXAS A&M UNIVERSITY SYSTEM
DEAN, COLLEGE OF ENGINEERING
DIRECTOR, TEXAS A&M ENGINEERING EXPERIMENT STATION (TEES)
HOLDER, HAROLD J. HAYNES DEAN’S CHAIR IN ENGINEERING

Dr. Banks has taught courses in applied microbial processes, remediation engineering and biochemical processes in environmental engineering. She has served as director of the Environmental Protection Agency Hazardous Substance Research Center, associate director of the NASA Center for Advanced Life Support and co-director of the 21st Century Center for Phytoremediation Research. She is a member of the National Academy of Engineering and is a Fellow of the American Society of Civil Engineers. Banks has served as editor-in-chief for the ASCE Journal of Environmental Engineering and associate editor of the International Journal of Phytoremediation.

**MARIA A. BARRUFET**

PROFESSOR, PETROLEUM ENGINEERING
BAKER HUGHES ENDOWED CHAIR

Dr. Barrufet’s research interests include the evaluation of different methods used to desalinate oil-field brines. She studies unit operation aspects of evaporators, membranes, osmotic separation, heat transfer, energy and mass balance computations. Barrufet advances the discussion of enhanced oil recovery, studying thermodynamics and transport phenomena applied to chemical, miscible and thermal recovery processes. She also evaluates rock and fluid properties in addition to multiphase flow.
Dr. Hasan is an expert in the subject of production engineering. He focuses on modeling complex transport processes in various components of petroleum production systems. Hasan's research group has pioneered systematic modeling of heat transfer in wellbores, and one of the most recognized impacts of this research is in production safety analysis. Hasan's solutions to problems involving transient heat flow situations have found application in flow assurance, flow metering and pressure transient testing.

Dr. Cagin’s research includes computational materials science and nanotechnology with emphasis on design, characterization and development of multifunctional, nanostructured materials for device and sensor applications. He performs fundamental studies on transport phenomena (heat, mass and momentum) at nanoscale and in confined media. He evaluates thermal, mechanical, electronic and magnetic properties, phase behavior of materials, materials for thermal management, power generation and energy harvesting, in addition to the development and application of multiscale simulation methods.

Dr. Nikolov's research interests include recovery of recombinant biomolecules, bioprocessing of transgenic plants and algae, protein purification, and bioprocess design and economics.

Dr. Rajagopal is recognized internationally for his significant contributions to the world of continuum mechanics, computational mechanics, biomechanics and technology. He was elected to the Hall of Fame for Engineering, Science and Technology (HOFEST), which includes such luminaries as George Eastman, Thomas Alva Edison, Albert Einstein, Henry Ford, Bill Gates, Louis Pasteur and George Westinghouse.

Dr. Scully’s research interests include laser physics, quantum optics, non-equilibrium statistical mechanics and bioengineering. His bioengineering work includes the first real-time measurement of small amounts of anthrax. Experiments were carried out in his Jack E. Brown lab. The Scully-Lamb quantum theory of the laser was the first theoretical treatment that yielded laser photon statistics, laser linewidth and all higher-order photon correlations. The theory was later extended to explain behavior of the single photon maser. Scully and his coworkers have demonstrated that the laser master equation analysis also provides a good quantitative description of fluctuations in the Bose-Einstein condensate.

Dr. Wooley’s research includes the fundamental development of synthetic methodologies that allow for the construction of increasingly complex polymers and nanostructured materials, including their hierarchical assembly into functional devices. Specific functional targets include nanoparticles for the treatment of infectious diseases and cancer of the lung and urinary tract, amphiphilic polymer coatings for anti-biofouling applications with emphasis on the marine environment, anti-icing polymer coatings and hybrid polymer-inorganic nanoparticles for oil-spill cleanup.

Dr. Chellam holds doctorate degrees in environmental engineering from Rice University. He has seven years of experience as a process engineer with J.K. Synthetics, India and as a research engineer in Montgomery Watson. His research interests broadly include advanced technologies for water purification and analysis of trace metals in airborne particulate matter. Chellam is currently serving as an elected member of the Board of Directors of the Association of Environmental Engineering and Science Professors and the North American Membrane Society.